

## ENERGY UNITS

In the International System of Units (SI), the unit of work or energy is the Joule (J). For very small amounts of energy, the erg (erg) is sometimes used. An erg is one ten millionth of a Joule:

$$1 \text{ Joule} = 10,000,000 \text{ ergs}$$

Power is the rate at which energy is used. The unit of power is the Watt (W), named after James Watt, who perfected the steam engine:

$$1 \text{ Watt} = 1 \text{ Joule/second}$$

Power is sometimes measured in horsepower (hp):

$$1 \text{ horsepower} = 746 \text{ Watts}$$

Electrical energy is generally expressed in kilowatt-hours (kWh):

$$1 \text{ kilowatt-hour} = 3,600,000 \text{ Joules}$$

It is important to realize that a kilowatt-hour is a unit of energy not power. For example, an iron rated at 2000 Watts would consume  $2 \times 3.6 \times 10^6 \text{ J}$  of energy in 1 hour.

Heat energy is often measured in calories. One calorie (cal) is defined as the heat required to raise the temperature of 1 gram of water from 14.5 to 15.5 °C:

$$1 \text{ calorie} = 4.189 \text{ Joules}$$

An old, but still used unit of heat is the British Thermal Unit (BTU). It is defined as the heat energy required to raise the energy temperature of 1 pound of water from 63 to 64°F.

Physical Quantity	Name	Symbol	SI Unit
Force	Newton	N	$\text{kg}\cdot\text{m}/\text{s}^2$
Energy	Joule	J	$\text{kg}\cdot\text{m}^2/\text{s}^2$
Power	Watt	W	$\text{kg}\cdot\text{m}^2/\text{s}^3$